B.Sc. Physics Programme

Semester-I

Core Course: I Credit – 2 (36 hours)

PH1CRT01: METHODOLOGY AND PERSPECTIVES OF PHYSICS

Module I

Concepts and Development Physics: (8hours)
Development of physics in the last century and the birth of new scientific concepts with reference to scientific contributions of Galileo, Newton, Einstein, J J Thomson, Curies, Rayleigh, Max Plank, Heisenberg and Schrodinger (qualitative understanding). Contributions of Indian physicists -C V Raman, H J Babha, J C Bose, S N Bose, M Saha, S Chandrasekhar, Vikram Sarabhai, (Topics in this part require qualitative study only)
References:
1. Feynman lectures of Physics
2. Concepts of Modern Physics: ArtherBeisser,
3. Modern Physics: Kenneth Krane
4. Modern Physics: R Murugeshan
5. https://www.nobelprize.org/nobel_prizes/physics/laureates/

Module II (18 hours)
Number systems- Decimal, hexadecimal and Binary. Conversions, Binary arithmetic addition, subtraction and multiplication. 1's and 2's complement subtraction –signed binary numbers. Signed binary arithmetic, BCD code, ASCII code, Significance of binary number system in digital electronics, microprocessors and in computers.

Introductory Vector Analysis - Applications of vectors in Physics. Differential and integral vector calculus: – The operator ▼- physical significance of Gradient, Divergence and Curl, Line integral, surface integral and volume integral of vectors
Co-ordinate systems:Cartesian Co-ordinate system, plane polar and spherical polar coordinates, cylindricalcoordinates (Basic ideas with examples in physics),

Module III
Experimental methods and error analysis (10 hrs)
Experimental methods, least count of instruments, Instruments for measuring mass, length, time, angle , current, voltage. Fundamental units. Precision and accuracy of measurements, source of error in measurements, necessity of estimating errors , types of errors, reading error of instrument, calibration error, random error, systematic error, significant digits, order of magnitude and rounding of numbers, rounding error, absolute and relative errors, Errors of computation- addition, subtraction, multiplication, division, error in power and roots, Propagation of errors, analysis of data, standard deviation, calculation of mean value.

References:
1. Text book: Advanced course in Practical Physics by D Chattopadhyay- Chapter-1
2. Practical Physics, G L Squires, Third edn. Cambridge University Press.
3. The theory of Errors in Physical Measurements- J C Pal- New Central Book Agency- 2010

Semester-II

Core Course: II **Credit – 2 (36 hours)**

PH2CRT02: MECHANICS AND PROPERTIES OF MATTER

Module I

Wave motion (4 hours)

General equation of wave motion, plane progressive harmonic wave, energy density, intensity of a wave, superposition of waves, beats, transverse waves in stretched strings, modes.

Text Book: Mechanics by D.S. Mathur – Chapter 9.

Oscillations (8 hours)

Periodic motion, simple harmonic motion and harmonic oscillator, energy of a harmonic oscillator, examples of harmonic oscillator – simple and compound pendulum. Theory of Damped harmonic oscillator. Theory of forced oscillator, resonance, applications.

Text Book: Mechanics by D.S. Mathur – Chapter 7, 8.

Module -II

Rotational mechanics (7 Hours)

Angular velocity- angular acceleration- angular momentum- conservation- torque-moment of inertia- Parallel and perpendicular axes theorems - calculation of moment of inertia- (rod, ring, disc, cylinder, and sphere). Theory of flywheel.

Text Book: Mechanics by D.S. Mathur – Chapter 10.

Module III

Elasticity (10 hours)

Basic ideas on elasticity – Young's modulus, bulk modulus, rigidity modulus, Poisson's ratio, relations connecting various elastic constants. Work done per unit volume in a strain. Bending of beams, bending moment, flexural rigidity. Young's modulus – uniform and non-uniform bending, cantilever. I –section girders. Determination of rigidity modulus using Static and Dynamic methods.

Text Book: Mechanics by D.S. Mathur – Chapter 12, 13.

Hydrodynamics (7 hours)

Streamline and turbulent flows, coefficient of Viscosity – Determination of viscosity by Poiseuille's method. Equation of continuity, energy possessed by a liquid, Bernoulli's theorem.

Surface tension, surface energy, excess pressure in a liquid drop and bubble, factors affecting surface tension, applications.

Text Book: Mechanics by D.S. Mathur – Chapter 14.

Text books:

1. Mechanics by J.C. Upadhayaya, Ramprasad Pub.
2. Mechanics -D.S.Mathur, S.Chand.
3. Advanced course in Practical Physics by D Chattopadhyay, Central Book
4. Properties of Matter and Acoustics by Murugeshan and K. Sivaprasath, S. Chand

References:

1. Mechanics- Hans and Puri, TMH
2. Classical Mechanics by J.C. Upadhyaya, Himalaya Pub.
3. Classical Mechanics-Takwale and Puranik, TMH.

4. Classical mechanics- K.SankaraRao, PHI.
5. Properties of Matter by Mathur, S. Chand,
6. Mechanics by Somnath Datta, Pearson
7. Mechanics by H.D Young and R.A Freedman, Pearson.

Semester-III

Core Course: III Credit – 3 (54 hours)
PH3CRT03: OPTICS, LASER AND FIBER OPTICS

Module I
Interference (13 hours)

Review of basic ideas of interference, Coherent waves-Optical path and phase changesuperposition of waves-theory of interference-intensity distribution. Young's double slit experiment, Coherence-Conditions for interference.
Thin films-plane parallel film- interference due to reflected light-conditions for brightness and darkness-interference due to transmitted light-Haidinger fringes-interference in wedge shaped film-colours in thin films-Newton's rings-applications. Michelson interferometer-construction, working and just mention the applications.

Text book: Optics by N.Subramanayam, Brijlal, M.N.Avadhanulu-Chapter 14 and 15.

Module II
Diffraction (10 hours)
Fresnel Diffraction – Huygens- Fresnel theory –zone plate –Difference between zone plate and convex lens. Comparison between interference and diffraction –diffraction pattern due to a straight edge, single silt. Fraunhoffer diffraction at a single slit, double slit,N slits, theory of plane transmission grating. Dispersive power and resolving power of grating.

Text book: Optics by N.Subramanayam, Brijlal, M.N.Avadhanulu-Chapter 17, 18 and 19.

Polarization (12hours)
Concept of polarization – plane of polarization- Types of polarized light-production of plane polarized light by reflection-refraction. Malu's law-Polarization by double refraction calcite Crystal. Anisotropic crystals-optic axis-Double refraction-Huygens explanation of double refraction. Retarders - Quarter wave plate and half wave plate. Production and Detection of plane, elliptically and circularly polarized light-Optical Activity- specific rotation.

Text book: Optics by N.Subramanayam, Brijlal, M.N.Avadhanulu-Chapter 20.

Module III
Laser (10 hours)
Absorption and emission of light-Absorption-spontaneous emission and stimulated emission, Einstein relations, Population inversion- Active medium-Pumping, different pumping methods, Resonators – plane mirror and confocal resonators – Metastable state, Three level and Four level Laser systems. Ruby Laser, He-Ne laser, Semiconductor Laser, Laser beam Characteristics, coherence. Applications of Laser, Holography (qualitative study only).

Text book: Optics by N.Subramanayam, Brijlal, M.N.Avadhanulu-Chapter 22 and 23.

Fiber Optics (9 hours)

Propagation of light in a fiber -acceptance angle, numerical aperture, V-number, single mode and multimode step index fiber –graded index fiber- attenuation- application of fiber-optical fiber communication – advantages.

Text book: Semiconductor physics and optoelectronics- V.Rajendran, J.Hemaletha and M.S.M.Gibson, Unit IV-Chapter 1.

References

1. Optics, E Hecht and AR Ganesan, Pearson
2. Optics, 3rd edition, AjoyGhatak, TMH
3. Optical Electronics, AjoyGhatak and K Thyagarajan, Cambridge
4. Optics and Atomic Physics, D P Khandelwal, Himalaya Pub. House
5. Optics, S K Srivastava, CBS Pub. N Delhi
6. A Text book of Optics, S L Kakani, K L Bhandari, S Chand.
7. Optics N.Subramanayam, Brijlal, M.N Avadhanulu S Chand.
8. Semiconductor optoelectronic devices: Pallab Bhattacharya, PHI 2009.
9. Lasers and Non linear Optics, BB Laud, New Age Int Pub. 2013
10. Laser Fundamentals, William T Silfvast, Cambridge Univ Press. 2012.
11. Optoelectronics an Introduction, J Wilson & JFB Hawkes, PHI 1999.
12. Fiber Optics and Optoelectronics, R P Khare, Oxford 2012..
13. Introduction to Optics, Frank L Pedrotti, Leno M Pedrotti& Leno S Pefrotti, Pearson 2014.
14. Optical fiber and fiber optic communication system (4th edition) Subir Kumar Sarkar, S Chand.

Semester-IV

Core Course: IV **Credit – 3 (54 hours)**

PH4CRT04: SEMICONDUCTOR PHYSICS

Module I

Semiconducting diodes and applications (14 hours)

PN Junction, Depletion layer, Barrier potential, Biasing- forward and reverse, Reverse breakdown, Junction capacitance and diffusion capacitance- PN Junction diode – V-I characteristics–Diode parameters, Diode current Equation, Diode testing, Ideal diode. Zener diode and its reverse characteristics. Thermistors. Rectification - Half wave, Full wave, Centre tapped, Bridge rectifier circuits - Nature of rectified output, Efficiency & Ripple factor-Filter circuits – Inductor Filter, Capacitor Filter, LC Filter, π Filter-Regulated Power supplies - Zener diode voltage regulator- Voltage multipliers – Doubler & Tripler- Wave shaping circuits - Clipper-Positive, negative and biased – Clampers- Positive, negative and biased.

Text Book: Basic Electronics- B.L.Theraja Chapters 13,14,15,17

A Text Book of Applied Electronics- R.S.Sedha Chapters-11, 12, 19, 20, 33

Module II

Transistors Configurations and Feed back (12 hours)

Bipolar junction transistors, Transistor biasing, CB, CC, CE configurations and their characteristics- Active, saturation and cut-off regions. Current gain α, β, γ and their relationships. Leakage currents- Thermal runaway. DC operating point and AC and DC Load line, Q-Point.

Basic principles of feedback, positive & negative feedback, Advantages of negative feedback, negative feedback circuits – voltage series & shunt, current series & shunt.

Amplifiers and Oscillators (12 hours)

Need for biasing-Stabilization- Voltage divider bias. Single stage transistor Amplifiers-CE amplifier - amplification factors. Decibel system, Variations in Amplifier gain with frequency.

Oscillatory Circuits, LC oscillators – Hartley Oscillator, Colpit's Oscillator, RC oscillators - Phase shift Oscillator. Astable and monostable multivibrator (basic idea only)

Text Book: Basic Electronics-B.L.Theraja-Chapters 18, 19, 20, 22, 24, 25, 28, 29.
A Text Book of Applied Electronics-R.S.Sedha Chapters 14, 15, 22,24, 29, 31, 32

Module III

FET, Operational Amplifier & Modulation (16 hours)

FET -characteristics, FET- Parameters. Comparison between FET and BJT. MOSFET (basic idea only) OP-amp- Symbol and terminals. Characteristics of ideal OP-amp, CMRR, Applications - inverting, Non-inverting, Unity follower and Summing amplifiers. Types of modulation – AM, FM, Pulse modulation and Phase modulation (qualitative study only). Amplitude modulation- modulation index - Analysis of AM wave – Sidebands –bandwidth-AM Demodulation.

Text Book: Basic Electronics-B. L. Theraja - Chapters 26, 30, 31
A Text Book of Applied Electronics-R.S.Sedha-Chapter-16, 35

References:

1. Principles of electronics, VK Mehta, S Chand
2. Basic Electronics(7thEdition), Malvino and Bates, TMH
3. Electronics Fundamentals and Applications- D. Chattopadhyay and P.G.Rakshit, New Age International Publishers.
4. Electronics: Fundamentals of Analog circuits, Thomas L. Floyd, David Buchla, Prentice Hall
5. Electronic Devices and Circuit Theory, Robert Boylestad, Louis Nashelsky, Prentice Hall
6. Basic Electronics, Debashis De , Pearson 2010
7. Basic Electronics, Santiram Kal, PHI 2010

Semester-V
Core Course: V Credit – 3 (54 hours)
PH5CRT05: ELECTRICITY AND ELECTRODYNAMICS

Module I
Alternating Current and Network Theorems (15 hours)

EMF induced in a coil rotating in a magnetic field - AC applied to resistive, inductive and capacitance circuits - AC applied to LR and RC circuits - Analysis of LCR series circuits - LCR parallel resonant circuit – comparison - Power in ac circuits - Wattless current - choke coil - transformer on no load- skin effect.
Ideal voltage source and current source - Superposition theorem - Reciprocity theorem - Thevenin's theorem - Norton's theorem - Maximum power transfer theorem.

Text Book: Electricity and Magnetism, R. Murugeshan- Chapters 13, 30 and 18

Module II
Transient Current and Thermo electricity (8 hours)
Growth and decay of current in an LR circuit- Charging and discharging of a capacitor through a resistor - Growth and decay of charge in an LCR circuit.

Seebeck effect - Laws of thermo emf - Peltier effect- Thomson effect- Thermoelectric diagrams -Thermocouple (qualitative study) - Explanation of thermoelectric effects based on electron theory.

Text Book: Electricity and Magnetism, R. Murugeshan- Chapters 12, 8 and 32.

Module III
Electrostatics and Magnetostatics (20 hours)
Fundamental theorems of divergence and curl (physical concepts) - Electric field - Continuous charge distribution- Divergence and curl of electrostatic field- Gauss's law and applications: solid sphere, infinite wire, infinite plane sheet - Electric potential - Poisson's and Laplace's equations - Potential of a localized charge distribution – Electrostatic boundary conditions- work and energy in electrostatics – The work done to move a charge – Energy of a point charge distribution and continuous charge distribution- Basic properties a conductor .

Lorentz Force law- Biot- Savart law- Divergence and curl of B- Applications of Amperes' law: long straight wire, infinite plane, solenoid – Comparison of electrostatics and magnetostatics- Magnetic vector potential – Magnetostatics boundary conditions Electromagnetic induction- Faraday's law

Text Book: Introduction to Electrodynamics, David J Griffiths, Chapters 1, 2, 5 and 7

Module IV
Maxwell's Equations and Electromagnetic wave propagation (11 hours)
Maxwell's equations - Boundary conditions for free space - Continuity equations- Poynting's theorem.
Wave equations (general idea on reflection at boundary and polarization) - Electromagnetic wave in vacuum - Wave equation for E and B - Monochromatic plane waves- Energy of electromagnetic waves.
Text Book: Introduction to Electrodynamics, David J Griffiths-Chapters 7,8 and 9

References:
1. Fundamentals of Magnetism and Electricity, D.N Vasudeva - S Chand
2. Principles of Electromagnetics, Mathew N.O Sadiku- 4th Ed. , Oxford
3. Electricity and Magnetism, KK Tewari- S Chand
4. Electricity and Electronics, Saxena, Arora and Prakash- Pragati Prakashan
5. Classical Electromagnetism, Jerrold Franklin- Pearson
6. Electromagnetic Fields and Waves, KD Prasad- Satya Prakashan
7. Field and wave Electromagnetics, David K Cheng- Pearson.

Semester-V
Core Course: VI Credit – 3 (54 hours)
PH5CRT06: CLASSICAL AND QUANTUM MECHANICS

Module I
Lagrangian and Hamiltonian Formulations of Classical Mechanics (15 hours)
Constraints, degrees of freedom, generalized co-ordinates, principle of virtual work, D'Alembert's principle, Lagrange's equations(no derivation required), Application of Lagrangian (Linear Harmonic oscillator, Planetary motion and Simple Pendulum only), Hamilton's Canonical equations of motion, Advantages of Hamilton's method, Applications of Hamilton's method (Linear Harmonic oscillator and Simple pendulum only).Hamilton's Principle of Least Action. Derivation of Lagrange's equation from Hamilton's Principle.
Text book: Classical Mechanics by J.C. Upadhyaya-Chapter 2 & 3.
Classical Mechanics by G. Aruldhas
Module II
Historical development and origin of quantum theory (9 hours)
Failure of classical physics- Black Body radiation-Planck's radiation law, Photoelectric effect-Einstein's explanation, Compton effect, Bohr's correspondence principle-Wave particle Dualism, Dual nature of matter- De Broglie hypothesis, Davisson-Germer Experiment, De Broglie waves, Wave packet, Group and phase velocities.

Text Book: A Textbook of Quantum Mechanics- G Aruldhas-Chapter 1
General Formalism of Quantum Mechanics (15 hours)
Linear vector space- Hilbert space- Orthogonality- Linear operator-Eigen functions and eigen values- Hermitian operator- Postulates of Quantum Mechanics- wave function, Operators, Expectation value, Eigen value, Time development- Simultaneous measurability- General uncertainty relation.

Text Book: A Textbook of Quantum Mechanics- G Aruldhas-Chapter 3 and 8

Module III
Schrödinger equation and its applications (15 hours)
Time dependent Schrödinger equation- interpretation of wave function, Probability density, Probability current density, Ehrenfest theorem- Extension to three dimensions- Time independent Schrödinger equation- Stationary states- Admissibility conditions of wave function-general properties of one dimensional Schrödinger equation, particle in a box, one dimensional barrier problem- square potential barrier.
Text Book: A Textbook of Quantum Mechanics- G Aruldhas.

Text Book:
1. Classical Mechanics by J.C. Upadhyaya. Himalaya Pub.

2. Concepts of Modern Physics- Arthur Beiser, TMH
References:
1. Concepts of Modern Physics- Arthur Beiser, TMH
2. A Textbook of Quantum Mechanics- G Aruldhas- (2nd Edition)- PHI
3. Classical Mechanics-Takwale and Puranik, TMH.
4. Classical mechanics- K.SankaraRao, PHI.
5. Introductory Quantum Mechanics- RI Liboff, Pearson
6. Quantum Physics- Gasiorowicz,John Wiely
7. Quantum Mechanics- Griffith, Pearson

Semester-V
Core Course: VII Credit-3 (54 hours)
PH5CRT07: DIGITAL ELECTRONICS AND PROGRAMMING

Module I
Boolean algebra and logic gates (9 hours)
Basic gates NOT, OR, AND. Universal Logic Gates- NOR, NAND. XOR and XNOR Gates. Rules and Laws of Boolean algebra. Duality theorem -De Morgan's Theorems. Analysis and simplification of logic circuits. Boolean equation and truth table - SOP andPOS. Minterms and Maxterms. Standard SOP and Standard POS- Conversion between Standard SOP & Standard POS. Karnaugh Map (up to four variables). K map SOP minimization.
Module II
Combinational logic (6 hours)
Half Adder and Full Adder, Half and Full subtractor, 4-bit parallel Adder/Subtractor. Multiplexer, De-multiplexer, Encoder & Decoder.
Sequential logic (13 hours)
Flip-flops, RS, Clocked RS, Master Slave JK FF, DFF, T Flip-flop, Buffer registers- Shift register-SISO and SIPO, Counters- Binary ripple counter. D/A converters (Ladder type), A/D Converter (Counter type).
Module III
Programming in C++ (26 hours)
Basic C++ program structure –comments-data types-variable types-constantsoperators(arithmetic, relational, logical and assignment operators)- if, if-else and else if, do while - case – loops(while, do-while, and for)-nested loops- arrays(Defining Arrays, Accessing Array Elements, Initializing Arrays)- basic ideas of functions(qualitative idea), object and classes. Programs using loops.
Text book: Object oriented programming in Turbo C++ - Robert Lafore (Galgotia Pub.) Chapter 2, 3 and 7.

Text books:
1. Digital fundamentals, Thomas L. Floyed (10th edition), Pearson
2. Digital principles and applications, Malvino, Leach and Saha (6th Edition) TMH
3. Digital electronics, S Salivahanan & S Arivazhagan VPH (2010)
4. Digital design, M Morris Mano, PHI
References:
1. Digital logic and computer design - M Morris Mano, PHI
2. Digital Electronics- William H Gothmann, PHI
3. Digital circuits and design- S Salivahanan and S Arivazhakan, PHI

4. Digital Electronics- Sedha, S Chand
5. Digital computer electronics- Malvino, Brown, TMH
6. Object oriented programming in Turbo C++ - Robert Lafore (Galgotia Pub.)

Semester-V
Core Course: VIII **Credit-4 (72 hours)**

PH5CRT08: ENVIRONMENTAL PHYSICS AND HUMAN RIGHTS

Module I
Unit 1: Multidisciplinary nature of environmental studies(2 hours)
Definition, scope and importance
Need for public awareness.

Unit 2: Natural Resources:(10 hours)
Renewable and non-renewable resources: Natural resources and associated problems.
a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies.
f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosionand desertification

- Role of individual in conservation of natural resources.
- Equitable use of resources for sustainable life styles.

Unit 3: Ecosystems (6 hours)
- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the given ecosystem:- Forest ecosystem

Module II
Unit 1: Biodiversity and its conservation (8 hours)

- Introduction
- Biogeograhical classification of India

- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- India as a mega-diversity nation
- Hot-sports of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts
- Endangered and endemic species of India

Unit 2: Environmental Pollution (8 hours)

Definition, Causes, effects and control measures of: -

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides.

Unit 3: Social Issues and the Environment (10 hours)

- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people: its problems and concerns, Case studiesEnvironmental ethics: Issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and holocaust, Case studies
- Consumerism and waste products
- Environment Protection Act
- Air (Prevention and Control of Pollution) Act
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation
- Public awareness

Module III

Non-renewable and Renewable Energy Sources (10 hours)

Non-renewable energy sources:-Coal, Oil, Natural gas; Nuclear fission energy; Merits and demerits of non-renewable energy. Renewable energy sources: Biomass energy- Biogas plant - Fixed dome type and moving dome type; Wind energy; Wave energy; Tidal energy; Hydroelectricity; Geothermal energy conversion; Ocean thermal energy conversion; Fusion energy; Hydrogen energy- Production (electrolysis) and storage; Merits and demerits of each renewable energy sources; Storage of intermittently generated renewable energy (qualitative); Fuel cell.

Module IV

Solar energy (10 hours)

Sun as a source of energy- Solar radiation, Solar Constant, Spectral distribution; Solar pond - Convective and salt gradient types; Flat plate collector; Solar water heater – Direct and indirect systems- Passive and active systems; Optical concentrator – Parabolic trough reflector - Mirror strip reflector - Fresnel lens collector; Solar desalination; Solar dryer - Direct and indirect type; Solar cooker; Solar heating of buildings; Solar green houses; Need and characteristics of photovoltaic (PV) systems; Solar cells - Principle, Equivalent circuits, V-I characteristics, fill factor, conversion efficiency; PV Sun tracking systems; Merits and demerits of solar energy.

Module – V (8 hours)

Unit 1- Human Rights– An Introduction to Human Rights, Meaning, concept and development, Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights).

Unit-2 Human Rights and United Nations – contributions, main human rights related organs - UNESCO, UNICEF, WHO, ILO, Declarations for women and children, Universal Declaration of Human Rights. Human Rights in India – Fundamental rights and Indian Constitution, Rights for children and women, Scheduled Castes, Scheduled Tribes, Other Backward Castes and Minorities

Unit-3 Environment andHuman Rights - Right to Clean Environment and Public Safety: Issues of Industrial Pollution, Prevention, Rehabilitation and Safety Aspect of New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal, Protection of Environment Conservation of natural resources and human rights: Reports, Case studies and policy formulation. Conservation issues of western ghats- mention Gadgil committee report, Kasthurirengan report. Over exploitation of ground water resources, marine fisheries, sand mining etc.

Internal: Field study

- Visit to a local area to document environmental grassland/ hill /mountain Visit a local polluted site – Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds etc
- Study of simple ecosystem-pond, river, hill slopes, etc

(Field work Equal to 5 lecture hours)

Semester-V

OPEN COURSE: Credit-3 (72hours)

PH5OPT01: Our Universe

Scope: To help the students to comprehend the cosmos and its origin and to develop scientific attitude and aptitude.

Prerequisites: This course in intended for the students of other disciplines. So a secondary level knowledge of mathematics and physics is enough to study this course. But an inquisitive mind and curiosity are essential from the part of a student.

Module I

Our universe (10 hours)

Early models of universe- Geo centric model- Ptolemy-Aristotle. Copernican model – Sun at the centre. Galileo and his observations. Planetary paths-Kepler’s laws (No need of derivation).

Galaxies-Hubble's classification – Spiral, elliptical & irregular galaxies. Milky way galaxy (qualitative).

Module II

Cosmology (14 hours)

Origin of the universe - Big bang theory – expansion of the universe – Hubble's law, age of the universe. Doppler effect and red shift(qualitative).

Stellar evolution – birth - red giant- death of a star. White dwarf- Chandrasekhar limit. Super novae- neutron star- black hole.

Text Books

1. Architecture of the universe. (cha 3,4,8 and 9) Necia H.Apfel and Allen Hynek-Benjamin Cummins Publishing Company.
2. Astronomy A Beginners guide to the universe sixth edition(Ch.12)-Chaisson Mc Millan
3. Cosmic vistas-A popular history of astronomy(chap 4,5,6,7,8) Biman Basu-national book trust,India
4. Astronomy; A Self Teaching Guide (cha 5&6)-Dinah L Moche
5. The Great Universe (cha 4,5,6,7) G.K Sasidharan-S.Chand

Module III

Observational Astronomy (24 hours)

Celestial sphere- cardinal points, celestial equator, ecliptic, equinoxes. Celestial coordinate systems-equatorial co-ordinate system-Right ascension & declination, Ecliptic and galactic co-ordinate systems. Diurnal motion of sun - Summer solstice and winter solstice. Time - apparent and mean solar time, International date line. Constellationszodiacal constellations. Astronomical distance scales – AU, Parsec and light year. Stellar Parallax and distance to stars from parallax. Optical Telescopes - Light gathering power, visual angle, angular magnification, Types of telescopes-refracting and reflecting – Newtonian and Cassegrain telescopes (No need ofderivation of magnification). HST, Radio telescopes, GMRT (India).

Text Books:

1. Astronomy A beginner's guide to the universe sixth edition(ch-1)-Chaisson Mc Millan
2. Astrophysics stars and galaxies (chap 2,4,20)K D Abhayankar
3. Joy of Star watching (ch- 3, 8 &10)- Biman Basu- National Book Trust, India
4. A textbook of Optics(ch-10) N.Subrahmanyan, Brijlal and M.N Avadhanulu
5. Astronomy; A Self Teaching Guide (cha 2&3)-Dinah L Moche
6. www.gmrt.ncra.tifr.in

Module IV

Solar system (24 hours)

The sun- solar atmosphere - Photosphere, chromospheres and corona. Sun spots. Definition of a planet- terrestrial planets & Jovian planets, Comparison of planets. Minor members of solar system- Asteroids, comets, meteors.

Universal law of gravitation. Earth's orbital motion-day to day changes-seasonal changes.

Text Books:

1. Architecture of the Universe (ch- 2, 14, 15, 17, 18, 19, 20)- Necia H. Apfel & Allen

Hynek- The Benjamin Cummings publishing company, Inc.
2. Astronomy A beginner's guide to the universe sixth edition(ch-1)-Chaisson Mc Millan
3. Astronomy; A Self Teaching Guide (cha 4,9,10,11)-Dinah L Moche
4. The great Universe – G.K Sasidharan-S.Chand

Semester-V
Open Course: Credits-3 (72 Hrs)
PH5OPT02: Physics in Daily Life

Module I
Unit 1 (8 hours)
Fundamental and derived quantities. Units and dimensions,dimensional analysis, order of magnitude, significant figures, errors.
Unit 2 Light (12 Hours)
Reflection, refraction, diffraction,interference, scattering(elementary ideas only) – examples from daily life – apparent depth, blue color of sky, twinkling of stars. Total internal reflection, mirage, sparkling of diamond, primary and secondary rainbow – optical fibers. Concave and convex mirrors, lenses – focal length, power of a lens, refractive index, prism, dispersion. Human eye, defects of the eye – myopia, hypermetropia, presbyopia and astigmatism and their correction by lens.
Module II
Unit 3 Motion (12 Hours)
Velocity, acceleration, momentum, Idea of inertia, force - laws of motion. Newton's law of gravitation, acceleration due to gravity, mass and weight, apparent weight, weightlessness.
Rotational motion, Moment of inertia, torque, centripetal and centrifugal accelerationexamples- banking of curves, centrifugal pump, roller coasters.
Unit 4 Electricity 10 Hours)
Voltage and current, ohms law. Electric energy, electric power, calculation of energy requirement of electric appliances – transformer, generator, hydroelectric power
Generation – wind power – solar power – nuclear power

Module III
Unit 5 Matter and energy (18 Hours)
Different phases of matter, fluids - surface tension, viscosity- capillary rise, Bernoulli's theorem and applications.
Heat energy, temperature, different temperature scales – degree Celsius, Fahrenheit and Kelvin.
Waves – transverse and longitudinal waves, sound waves, Doppler Effect.
Lasers, fluorescence, phosphorescence, electromagnetic waves – applications – microwave oven, radar, super conductivity.

Unit 6 Universe (12 hours)
Planets, – solar system, moon- faces of moon, lunar and solar eclipses, constellations, Different types of stars, Galaxies, black hole. Satellites, Artificial satellites, Global positioning system. Geo stationary satellite.

Reference Texts
1. Fundamentals of Physics with Applications by Arthur Beiser
2. Conceptual Physics by Paul G Hewitt

Semester-V

OPEN COURSE: Credit-3 (72hours)

PH5OPT03: COMPUTER HARDWARE AND NETWORKING

Module I (24 hours)

Microprocessors – Basic concepts of Intel 80186, 80286, 80386, 80486 and Pentium processors. Motherboard, Expansion buses, Memory, upgrading / adding memory, BIOS Motherboard – removing, installing / configuring motherboards, BIOS set up, troubleshooting memory.

Module II (24 hours)

Data storage devices, IDE and SCSI controllers, hard disk, installing / upgrading CD ROM drives, DVD, Optical storage, Tape back – ups. Printers, Keyboards, pointing and positioning devices, digital camera, Scanners, Monitors, Hard disks- installing / upgrading, troubleshooting, formatting, Error codes, BIOS disk routines

MODULE III (24 hours)

Multimedia, Graphical accelerators, audio, modems, I/E add on, Networks, Power supplies, UPS Printer installation, Software installation – DOS, Windows 95, 98, Linux, WindowsNT – installation, Administration, Installing PASCAL, C, ORACLE, VISUAL BASIC, Software diagnostics – PC tools, Norton utilities, XT/AT diagnostics, Viruses and anti-viruses.

References:

1. IBM PC and CLONES- Hardware, troubleshooting and maintenance – B Govindarajalu
2. PC Hardware, a beginners guide – Ron Gilster
3. All about Motherboard: - Manahar Lotia, Pradeep Nair

Semester-VI

Core Course: IX Credit-3 (54 hours)

PH6CRT09: THERMAL AND STATISTICAL PHYSICS

Module I

Equation of state for gases (5 hours)

Equation of an ideal gas, behavior of real gases, Andrew's experiment on carbon dioxide, critical state, two phase region, intermolecular forces, van der Waals equation of state, van der Waals isotherms, critical constants, limitation of van der Waals equation.

Zeroth law of thermodynamics (4 hours)

Thermodynamic system, surroundings, variables, thermal equilibrium: zeroth law, thermodynamic equilibrium, thermodynamic processes, reversible and irreversible processes, equation of state, expansivity and compressibility.

First laws of thermodynamics (7 hours)

Internal energy, heat, work, cyclic processes, first law, heat capacity, energy equation and difference of specific heat capacities, indicator diagram work done in reversible isothermal expansion of ideal gas, work done in reversible adiabatic expansion of ideal gas.

Heat engines and second law of thermodynamics (5 hours)

Second law statements, heat engine, efficiency, Carnot's ideal heat engine, work done by the engine per cycle, reversibility, Carnot refrigerator, heat pump, Carnot theorem, absolute scale of temperature, Clausius- Clapeyron latent heat equation.

Text Book: Thermal and Statistical Physics, R.B. Singh, part-1 chapter 3, 4, 5 and6

Module II

Entropy (5 hours)
Definition of entropy, principle of increase of entropy, entropy and unavailable energy, change in entropy in heat conduction, change in entropy in reversible and irreversible process, efficiency of Carnot cycle from TS diagram, entropy of an ideal gas, entropy and disorder.

Thermodynamic relations (8hours)
Maxwell's thermodynamic relations, TdS equations, energy equation, heat capacity equations, thermodynamic functions, third law of thermodynamics.

Conduction and radiation (4 hours)
Conduction, thermal conductivity, thermal conductivity of bad conductor Lee's disc experiment -thermal resistance, thermal radiation and its properties, fundamental definitions of energy flux, intensity and radiant emittance, Stefan's law, Stefan-Boltzmann law.

Text Book: Thermal and Statistical Physics, R.B. Singh, part-1 chapter7,8,10 and 11.

Module III

Statistical mechanics (8 hours)
Microstates and macrostates, Phase space, density of states, mu space and Gamma space, principle of equal a priori probability, ergodic hypothesis, statistical equilibrium, ensemble,ensemble formulation of statistical mechanics, microcanonical, canonical and grand canonical ensemble, partition function, average energy of particle, equipartition theorem.

Statistical distributions (8 hours)
Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics, distribution laws, Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein distribution.

Text Book: Thermal and Statistical Physics, R.B. Singh, part-2, Chapters 2, 3,4 and 5.

Text Book:
1. Thermal and Statistical Physics, R.B. Singh, New Age Pub. (2010)

References:
1. An introduction to thermodynamics by Y.V.C. Rao (New Age Pub.)
2. An introduction to Thermal Physics by D.V. Schroeder (Pearson Pub.)
3. Heat and thermodynamics by Mark W Zemansky, Richard H Dittman & Amit K Chattopadhyay. MCH New Delhi.
4. Thermodynamics and Statistical physics Brij Lal, N.Subrahmanyam and P S Hemne (S. Chand &Co, Multi colour edition 2007).
5. Berkeley Physics Course Volume 5; Statistical Physics; Frederick Reif. McGraw Hill.
6. Statistical Mechanics, R.K. Pathria, Pergamon press, Oxford

Semester-VI
Core Course: X Credit-3 (72 hours)
PH6CRT10: RELATIVITY AND SPECTROSCOPY
Module I
Special Theory of Relativity (18 hours)
Inertial and non inertial frames of reference- Galilean transformation, Significance of Michelson-Morley experiment, Postulates of Special Theory of Relativity, Lorentz transformation, Spatial contraction, Time dilation, composition of velocities, mass of moving particle, Equivalence of mass and energy. Introductory concept of general theory of relativity.
Text Book: Modern Physics, Kenneth S Krane. Concepts of modern Physics, Arthur Beiser

Module II

Atomic Spectroscopy (21 hours)

Historical introduction. Electrostatic spectrum. Types of spectra. Absorption and emission of light by atoms, quantum theory, early atom models – Bohr model, electron spin and magnetic moment, Exclusion principle, Stern-Gerlach experiment, Vector atom model, quantum numbers associated with vector atom models, Total angular momentum and LS coupling, fine structure of Sodium D lines, Zeeman effect, quantum mechanical explanation for anomalous Zeeman effect, Paschen-Back effect.

Text Book: Molecular structure and Spectroscopy, G Aruldas.
Concepts of modern Physics, Arthur Beiser

Module III

Molecular Spectroscopy (21 hours)

Molecular energy levels. Electronic, rotational and vibrational energies, rotational spectra, explanation in terms of rigid rotator model, vibrational energy levels, explanation in terms of harmonic oscillator.

Electronic energy levels of atoms, Fluorescence and phosphorescence, Raman effect – experimental arrangement and result, classical theory and its failure, quantum theory of Raman effect. IR and Microwave spectroscopes.

Text Book: Fundamentals olf Molecular Spectroscopy, C.Banwell and E. Mccash. Molecular structure and Spectroscopy, G Aruldas.

NMR and ESR Spectroscopy (12 hours)

NMR Spectroscopy- Basic principles and instrumentation- Medical applications of NMR.

Text Book: Molecular structure and Spectroscopy, G Aruldas – Chapter 10 (Sections 10.1, 10.2,10.3 and 10.19).

ESR Spectroscopy- Basic principles and instrumentation.

Text Book: Molecular structure and Spectroscopy, G Aruldas – Chapter 11 (Sections 11.1, 11.2 and 11.3**).**

Text Books:

1. Molecular structure and spectroscopy, Aruldas 2nd ed. EEE.
2. Modern Physics, Kenneth S Krane (2nd Edition) -Wiley.
3. Concepts of modern Physics, Arthur Beiser (6th Edition) - SIE.

References:

1. Spectroscopy: Straughan and Walker –(Vol.1) John Wiley
2. Fundamentals of Molecular Spectroscopy: CN Banwell –(4th edition) TMH .
3. Introduction to Atomic Spectra, HE White, TMH
4. Elements of spectroscopy, Guptha, Kumar and Sharma (Pragathi Prakash)
5. Special Relativity- Resnick, (Wiley)
6. Mechanics – D.S.Mathur (S.Chand).
7. Mechanics by J.C. Upadhayaya (Ramprasad)
8. Semiconductor physics and optoelectronics- V Rajendran, J Hemaletha and M S M Gibson.

Semester-VI

Core Course: XI **Credit - 3 (54 hours)**

PH6CRT11: NUCLEAR, PARTICLE PHYSICS AND ASTROPHYSICS

Module I

Nuclear structure (10 hours)

Nuclear composition – Discovery of neutron – Nuclear electrons - Nuclear properties: Nuclear radii – Spin and magnetic moment - Stable nuclei - Binding energy- Binding energy curve, Liquid drop model - Semi empirical binding energy formula with correction factors - Shell model - Nuclear forces- Meson theory of nuclear forces – Discovery of pion – Virtual Photons

Nuclear Radiation Detectors, Counters and Particle Accelerators (8 Hours)

Interactions between energetic particles and matter (basic concepts only) – Ionization chamber - Solid state detectors - Proportional counter - Geiger-Muller counter – The Wilson cloud chamber - Bubble chamber - Scintillation counters - Van de Graaff generator - Linear accelerator - Cyclotron - Betatron

Module II

Nuclear Transformations (15 hours)

Radioactive decay – Radiation hazards – Half life – Radiometric dating – Radioactive series - Alpha decay, tunnel theory of alpha decay, derivation for alpha decay constant - Beta decay, positron emission, electron capture, inverse beta decay – Gamma decay - The concept of interaction cross section, reaction rate – Nuclear reactions, Resonance, Center of mass coordinate system, Q value of nuclear reaction – Nuclear fission – Nuclear reactors – Breeder reactors - Nuclear fusion in stars – Formation of heavier elements – Fusion reactors – Confinement methods

Cosmic rays (4 hours)

Latitude effect – Azimuth effect – Altitude effect - Primary cosmic rays – Secondary cosmic rays – Cosmic ray showers – Discovery of Positron – Mesons Van Allen belts – Origin of cosmic rays

Module III

Particle Physics (10 hours)

Interactions and Particles – Leptons – Neutrinos and Antineutrinos, other leptons – Hadrons – Resonance particles – Elementary particle quantum numbers – Basic concepts of symmetries and conservation principles – Basic concepts of Quarks – color, flavor, Quark confinement – Higgs boson

Astrophysics (7 hours)

Classification of stars – Hertzsprung - Russel diagram – Luminosity of a star – Stellar evolution - White Dwarfs - Chandrasekhar limit - Neutron stars - Black holes - Supernova explosion – Photon diffusion time.

Text Book:

1. Concepts of Modern Physics, Arthur Beiser, 6th Edition, Tata McGraw-Hill publishing company
2. Modern Physics, R Murugeshan and K. Sivaprasath, 15th Edition (Revised) (2010), S.Chand

References:

1. Atomic and Nuclear Physics, S N Ghoshal, S.Chand.
2. Nuclear and Particle Physics S L Kakani and Subhra Kakani -Viva Books 2008
3. Elements of Nuclear Physics, M L Pandya and R P S Yadav, Kedar Nath Ram

Nath
4. Modern Physics, Kennth Krane, 2nd Edition, Wiley India (Pvt) Ltd.
5. Modern Physics , G. Aruldhas and P. Rajagopal, Prentice-Hall India
6. An Introduction to Astrophysics, Baidyanath Basu, 2nd Edition, Prentice-Hall India

Semester-VI
Core Course: XII **Credit-3 (72 hours)**
PH6CRT12: SOLID STATE PHYSICS
Module I
Crystal structure (18 hours)
Solid state, crystalline, polycrystalline and amorphous materials, crystal lattice, periodicity, translation vectors, unit cell, basis, symmetry operations, bravais lattice in two and three dimensions, miller indices, interplanar spacing, simple crystal structures-hcp, fcc, bcc and simple cubic, Structures of NaCl, Diamond and ZnS, X-ray diffraction from crystals- Bragg's law, powder method, reciprocal lattice-properties, reciprocal lattice to sc, bcc and fcc, Bragg's law in reciprocal lattice.

Text book: Solid State Physics by Puri and Babbar- Chapter 1 & 2

Module II
Bonding in solids (7 hours)
Inter-atomic forces, ionic bonding, bond dissociation and cohesive energy, madelung energy, covalent bonding, metallic bonding, hydrogen bonding, van derwaals bonding (basic ideas only).
Text book: Solid State Physics by Puri and Babbar

Free electron theory and elementary band theory (12 hours)
Free electron gas in one dimension, three dimension, electronic specific heat, band theory, Bloch theorem, Kronig-Penney model (derivation not expected), energy-wave vector relations, different zone schemes, velocity and effective mass of electron, distinction between metals, insulators and semiconductors.

Semiconducting properties of materials (12 hours)
Intrinsic and extrinsic semiconductors, drift velocity, mobility and conductivity of intrinsic semiconductors, carrier concentration and Fermi level for intrinsic semiconductor, carrier concentration, conductivity and Fermi level for extrinsic semiconductor. Hall Effect, Direct and Indirect band gap, Principles of LED and Photodiodes.

Text book: Solid State Physics by Puri and Babbar Chapter 5, 6 and 7

Module III
Dielectric properties of materials (5 hours)
Polarization and susceptibility, local filed, dielectric constant and polarizability, sources of polarizability, Clausius-Mossoti relation, piezoelectricity.

Magnetic properties of materials (7 hours)
Response of materials to magnetic field, classification of magnetic materials, Langevin's

classical theory of diamagnetism and paramagnetism, ferromagnetism, Weiss theory, domain theory, antiferromagnetism and ferrimagnetism.

Superconductivity (10 hours)

Origin of superconductivity, response of magnetic field, Meissner effect, super current and penetration depth, critical field and critical temperature, type-I and type –II superconductors, thermodynamic and optical properties, isotope effect, Josephson effect and tunneling- SQUID BCS theory-Cooper pairs-Existence of bandgap.

Text book: Solid State Physics by Puri and Babbar Chapter 5, 6 and 7

Text book:

1. Solid State Physics by Puri and Babbar (S.Chand)

References:

1. Solid State Physics, M.A. Wahab, (2nd Edition), Narosa
2. Introduction to Solid State Physics, Charles Kittel, (7th Edition), Wiley
3. Crystallography applied to solid state Physics, AR Verma, ON Srivastava, New age
4. Solid State Physics, AJ Dekker- Macmillian.
5. Solid State Physics, NW Ashcroft, ND Mermin – Cengage Learning.
6. Elementary Solid State Physics, M. Ali Omer, Pearson.
7. Solid state physics, R L Singal, KNRN &Co.
8. Solid state physics, S O Pillai, New age

Choice Based Course – XIV-1 Credit – 3 (54 hours)

PH6CBT01: INFORMATION TECHNOLOGY

Scope: To learn about the fascinating world of information technology and to use the tools available in Internet and the World Wide Web for a deep study of the subjects related to physics in better way by the students themselves.

Prerequisites: Awareness of basic computer operations.

Module I (20 hours)

Information and its Use : Information Technology – Quality of information – Message transmission – Electronic Office – E mail – Document storage – Computers in Industry – Different types – Graphical user interface

Text book: "Information Technology – The Breaking Wave", D.Curtin, K.Sen and K.Morin, Tata McGraw Hill, 1999. Chapter – 1, 2

Computer Networks: Importance of Networks. Components of Networks. Classification of Networks: Broad cast networks-Switched networks. Switching Techniques. Types of Networks – LAN – MAN – WAN. Networking Models – OSI reference model – TCP/IP reference model-Comparison between the OSI and TCP/IP models. Network Topology – Bus- Star-Ring-Tree-Mesh-Cellular.

Text book: Computer Networks, A.S. Tanenbaum - Prentice Hall of India, Chapter - 1
Computer Fundamentals, P.K. Sinha 3rd Edn. BPB Publications, Chapter – 17

THE INTERNET: Internet Protocols – Internet Protocol (IP)-Transmission Control Protocol (TCP) -Internet Address – Structure of Internet Servers Address-Address Space- Services on Internet – Domain Name System-SMTP and Electronic mail – Http and World Wide Web-Usenet and News groups-FTP-Telnet-Network Security -Digital Signature-E-mail Privacy-

Internet Tools – Search Engines-Web browsers- Internet explorer, Netscape Navigator, Mozilla Firefox(Working Knowledge)

Text book: Computer Networks, A.S.Tanenbaum - Prentice Hall of India, Chapter –5, 6, 7 Computer Fundamentals, P.K. Sinha 3rd Edn. BPB Publications, Chapter – 18

Module – II (20 hours)

THE HTML: What is HTML? Basic Tags of HTML – HTML-TITLE-BODY - Starting an HTML document – The <!DOCTYPE>declaration-setting boundaries with <HTML>-the HEAD element-the BODY element-the STYLE element and the SCRIPT element. - Formatting of text– Headers-Formatting Tags-PRE tag-FONT tag-Special Characters. Working with Images- META tag -Links – Anchor Tag -Lists – Unordered Lists-Ordered Lists-Definition Lists -Tables –TABLE, TR and TD Tags-Cell Spacing and Cell Padding-Colspan and Rowspan -Frames –Frameset-FRAME Tag-NOFRAMES Tag - Forms – FORM and INPUT Tag-Text Box-Radio Button-Checkbox-SELECT Tag and Pull Down Lists-Hidden-Submit and Reset

Text book: HTML4 – 2nd Edn. Rick Darnell, Techmedia, Chapter – 1, 2,3,4,5

Module – III (14 hours)

Basic Idea of DBMS: Need for Data Base – Database Systems versus File systems - View of Data - Data Abstraction-Instances and Schemas - Data Models – ER Model- Relational Model- Network Model-Hierarchical Model (general ideas) -Basic ideas about Structured Query Language.

Text book: Fundaments of Database System – Elmasri, Ramez and Navathe Shamkant B. 4th Edn.Person Education, India, 2004. Chapter – 1

MS – OFFICE/OPEN OFFICE (Working Knowledge): Word processors – PowerPoint - Spreadsheets – Databases

(No specific text book is preferred. MS office (97, 98, 2000, /Open Office which is installed in the lab can be used. Working practice must be given)

References

1. “Information Technology – The Breaking Wave”, D.Curtin, K.Sen and K.Morin,Tata McGraw Hill, 1999.
2. Computer Networks – A.S. Tanenbaum - Prentice Hall of India
3. Computer Fundamentals – P.K. Sinha 3rd Edn. BPB Publications
4. Internet and World Wide Web – Deitel
5. HTML4 – 2nd Edn. Rick Darnell, Techmedia
6. Database System Concepts – Silberschatz-Korth-Sudarshan 4th Edn – TataMac Graw Hill
7. “Information Technology and systems”, Green, B.C., Longman Scientific
8. Networks – Tirothy S. Ramteke – 2nd Edn. Pearson Edn – New Delhi, 2004
9. Data and Computer Communucation, William Stalling, PHI, New Delhi.
10. Mastering HTML4 – Ray D.S. and Ray E.J. – BPB
11. HTML – The Complete Reference – Tata Mc Graw Hill
12. Fundaments of Database System – Elmasri, Ramez and Navathe Shamkant B. 4thEdn.v Pearson Education, India, 2004.

Semester-VI

Choice Based Course – XIV-2 Credit-3 (54 hours)

PH6CBT02: MATERIAL SCIENCE

Module I (18 hours)

Structure and Properties of Materials

Classification of materials- Advance materials- Level of structures, Microstructure and Macrostructure, Structure-Property relationships, Physical properties of materials- Imperfections in solids- Point defects, imperfections, dislocations- interfacial and bulk defects. Diffusion Mechanisms- Fick's first and second laws. Mechanical Properties- Stress strain relationship, Basic ideas of anelasticity, plastic deformation, tensile properties, ductility, malleability, brittleness, toughness, resilience, hardness, stiffness, endurance, creep and impact strength- Basic Thermal properties, Thermal cracking- Electrical and Magnetic properties- Dielectric strength and dielectric constant- Basic ideas of Chemical properties

Text Book: Callister's Material Science and Engineering-Adapted by R Balasubramaniam, Wiley

Module II (18 hours)

Optical Properties of Materials

Absorption processes- Fundamental absorption-Exciton absorption- Free –carrier absorption- Photoconductivity- Photoelectric effect- Photovoltaic effect- Photoluminescence-colour centres-Generation of colour centres

Text Book: Solid State Physics, M.A. Wahab, Chapter-15

Modern Engineering Materials

Display devices- active and passive-Liquid crystals- Types of Liquid crystals- Nematic liquid crystals-Cholesteric liquid crystals- Smectic liquid crystals-General features of liquid crystals- Numeric display using LCD Metallic glasses; Shape memory alloy; lead free solders
Text Book: Semiconductor Physics and Optoelectronics, V.Rajendran et al.

Unit-II

Module III (18 hours)

Nanoscience

Metal nanoclusters-magic numbers, theoretical modelling, geometric and electronic structure, magnetic clusters; Semiconducting nano particles- Rare gas and molecular clusters- carbon nanostructures- Carbon clusters, CNT preparation, properties and applications; Quantum wells, wires and dots – preparation, Size and dimensionality effects, applications .

Text Book: Modern Physics by Murugeshan Material Characterization Techniques
Qualitative study of Powder XRD, SEM, SPM, TEM, STM, AFM, PES and Raman spectroscopy.

Text Book: Nanotechnology-The science of small- MA Shah and KA Shah, Chapter 5

Text Books:

1. Text Book: Callister's Material Science and Engineering-Adapted by R Balasubramaniam, Wiley
2. Solid State Physics (2nd ed.), M.A. Wahab, Narosa pub.
3. Nanotechnology-The science of small, MA Shah and KA Shah, Wiley.
4. Text Book: Modern Physics by Murugeshan
5. Semiconductor Physics and Optoelectronics, V.Rajendran et al., Vikas PublishingHouse.

References:

1. Crystallography applied to solid state Physics, A.R Verma, O.N Srivastava, New age
2. Nanotechnology, L.E Foster, Pearson.
3. Nanotechnology: Principles and Practices, 2nd edition, Sulabha K Kulkarni, Springer.
4. Introduction to Nanotechnology, C.P Poole, F.J Owens –Wiley
5. Textbook of Nanoscience and Nanotechnology, BS Murthy, P Shankar, Baldev Raj,BB Rath and J Murday- Universities Press-IIM

Semester-VI
Choice Based Course – XIV-3 Credit-3 (54 hours)
PH6CBT03: COMPUTATIONAL PHYSICS
Algorithms of all methods required
Module I (18 hours)
Solutions of Nonlinear Equations
Bisection Method - Newton Raphson method (two equation solution) – Regula-Falsi Method, Secant method - Fixed point iteration method - Rate of convergence and comparisons of these Methods
Solution of system of linear algebraic equations: Gauss elimination method with pivoting strategies-Gauss-Jordan method-LU Factorization, Iterative methods (Jacobi method, Gauss-Seidel method)
Module II (18 hours)
Curve fitting: Regression and interpolation
Least squares Regression- fitting a straight line, parabola, polynomial and exponential curve Finite difference operators-forward differences, divided difference; shift, average and differential operators- Newton's forward difference interpolation formulae- Lagrange interpolation polynomial- Newton's divided difference interpolation polynomial
Module III (18 hours)
Numerical Differentiation and Integration
Numerical Differentiation formulae - Maxima and minima of a tabulated function- Newton-Cote general quadrature formula - Trapezoidal, Simpson's 1/3, 3/8 rule – Solution of ordinary differential equations Taylor Series Method, Picard's method-Euler's and modified Euler's method –Heun's method- Runge Kutta methods for 1st and 2nd order

Text Books:

1. Numerical Methods, Balagurusamy, TMH
2. Numerical Methods for Scientists and Engineers- K Sankara Rao- PHI
3. Introductory Numerical Methods, S S Sastry, PHI.

Semester-VI
Choice Based Course – XIV-IV Credit – 3 (54 hours)
PH6CBT04: INSTRUMENTATION

Module I (10 hours)
Measurements and Measurement Systems
Measurements-Method of measurement-Instruments and measurement systems- Mechanical, Electrical and Electronic instruments-Classification of Instruments- Applications of Measurement Systems - Elements of generalized measurement systems

Text book: A Course in Electrical and Electronics Measurements and Instrumentation, Sawhney. A.K- Chapter 1

Module II (18 hours)

Primary Sensing Elements and Transducers

Mechanical Devices as Primary Detectors – Mechanical Spring Devices – Pressure Sensitive Primary Devices – Flow Rate Sensing Elements - Transducers-Classification– Characteristics (Static and Dynamic) and Choice of Transducers – Characterization

Text book: Sensors and Transducers, Patranabis D., Chapter 1
A Course in Electrical and Electronics Measurements and Instrumentation, Sawhney. A.K- Chapter 25

Module III (18 hours)

Resistive, Inductive and Capacitive Transducers

Potentiometers –Strain gauges (Theory, types) - Rosettes – Resistance thermometer – Thermistors (materials, Constructions, Characteristics) – Thermocouples-Self inductive transducer – Mutual inductive transducers – Linear Variable Differential Transformer – LVDT Accelerometer – RVDT – Synchros – Capacitive transducer – Variable Area Type – Variable Air Gap type – Variable Permittivity type – Capacitor microphone.

Miscellaneous Transducers (8 hours)

Light transducers (photo-conductive, photo emissive, photo-voltaic, semiconductor, LDR)– Piezoelectric transducer – Hall Effect transducers – Digital Encoding transducers Text book: A Course in Electrical and Electronics Measurements and Instrumentation, Sawhney. A.K- Chapter 1 and 25

Text books:

1. A Course in Electrical and Electronics Measurements and Instrumentation, Sawhney A.K, 18th Edition, Dhanpat Rai & Company Private Limited, 2007.
2. Sensors and Transducers, Patranabis D., 2nd edition, PHI, 2015.

References:

1. Measurement Systems-Applications and Design, Doebelin. E.A, Tata McGraw Hill
2. Sensors and Transducers, Patranabis. D, Prentice Hall of India
3. Principles of Measurement Systems John. P, Bentley,, III Edition, Pearson
4. Transducers and Instrumentation, Murthy.D.V.S,, Prentice Hall of India
5. Instrumentation- Devices and Systems, Rangan, Sarma, and Mani, Tata-McGrawHill
6. Electronic Instrumentation by H.S Kalsi, McGrawHill
7. Instrumentation measurements and analysis, Nakra & Choudhary, Tata-McGrawHill
8. Mechanical and industrial measurement by R.K. Jain, Khanna Publishers, New Delhi

Semester-VI

Choice Based Course – XIV-V **Credit – 3 (54 hours)**

PH6CBT05: Astronomy and Astrophysics

Module I

Observational astronomy (12 Hours)

Astronomical distance scales – AU, Parsec and light year. Stellar Parallax and distance to stars from parallax. Magnitude scale - Apparent and absolute magnitudes. Variable stars as distance indicators. Cepheid variables. Astronomy in different bands of electromagnetic radiation- Optical, radio and X-ray astronomies, Radiation Laws. Optical Telescopes. Types

of telescopes-refracting and reflecting – Newtonian and Cassegrain telescopes. Magnification and f number. Resolving Power, Telescope mounts – alt-azimuth and equatorial mounts.
Text Book : K D Abhyankar Section 3.1 & 4.3, Ian Morison Chapter 5, Dinah L. Moché, Chapter 2 &3.

Module II

Celestial sphere (8 Hours)

Concept of celestial sphere - cardinal points, celestial equator, ecliptic, equinoxes. Diurnal motion of sun - summer solstice and winter solstice. Celestial co-ordinate systems: – Horizon system – Azimuth & Altitude, Equatorial system-Right ascension & declination, Ecliptic coordinate system. Time - apparent and mean solar time, sidereal time. Twilight, Seasons-causes of seasons (qualitative ideas). International Date Line.
Text Book:K D Abhyankar, Chapter 2 & Dinah L. Moché, Chapter 1

Sun (5 Hours)

Sun - solar atmosphere and internal structure – Photosphere, chromosphere and corona. Radiation zone & Convection Zone. Sun spots, Activity Cycles, flares, prominences, coronal holes, Solar wind.

Text Book: Dinah L. Moché, Chapter 4, Ian Morison Chapter 2

Galaxies (3 hours)

Galaxies - our galaxy, galaxy types & turning fork diagram. Structure on the largest scaleclusters, super clusters and voids.
T**ext Book**: Dinah L. Moché, Chapter 6

Module III

Astrophysics (14 hours)

Gravitational contraction - Virial theorem, Jeans mass. Energy production inside stars. Thermonuclear fusion. Hydrogen burning. p-p chain. CNO cycle. Evolution of stars – birth – protostar, hydrostatic equilibrium, red giant, late stages of evolution - white dwarfs & Chandrasekhar limit, Neutron stars, Supernovae, Pulsars, Black holes. Stellar Classification, H-R diagram - Main sequence stars

Text Book: K D Abhyankar, Chapter 10, Dinah L. Moché Chapter 5

Cosmology (12 hours)

Large scale structure of the universe – isotropy and homogeneity. Cosmological principle. Standard big bang model - GUT, Planck Epoch, Inflation, Nucleosynthesis, Recombination & CMBR. Expanding universe - red shift. Hubble's law and Hubble parameter. Age of universe and its determination. Dark energy and Dark Matter (qualitative idea).

Text Book: Dinah L. Moché Chapter 7 & Ian Morison Chapter 9

References:

1. A short history of the Universe – Joseph Silk
2. Introduction to Astronomy and Cosmology, Ian Morison, John Wiley & Sons, Inc.
3. ASTRONOMY, A Self-Teaching Guide, Dinah L. Moché, John Wiley & Sons, Inc.
4. Introduction to cosmology- J V Narlikar

5. http://www.astro.cornell.edu/academics/courses/astro201/topics.html
6. http://www.ualberta.ca/~pogosyan/teaching/ASTRO_122/lectures/lectures.html
7. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
8. Astrophysics: Stars and Galaxies- K D Abhyankar

PRACTICALS

SEMESTER 1&2 (First Year)

Core Practical 1: PH2CRP01 – Mechanics and Properties of Matter
1. Symmetric Compound Pendulum – Determination of acceleration due to gravity (g), radius of gyration(K) and moment of inertia (I)
2. Asymmetric Compound Pendulum – Determination of acceleration due to gravity (g), radius of gyration(K) and moment of inertia (I)
3. Kater's pendulum – Determination of acceleration due to gravity (g)
4. Torsion Pendulum – Determination of rigidity modulus (n) and moment of inertia (I)
5. Torsion Pendulum (Method of equal masses) – Determination of rigidity modulus (n) and moment of inertia (I)
6. Measurement of density of a solid – Sensibility method to find mass using beam balance and screw gauge / venier calipers for dimension measurements
7. Uniform bending – Pin and Microscope – Determination of Young's modulus
8. Non Uniform bending – Pin and Microscope – Determination of Young's modulus
9. Uniform bending – Optic Lever – Determination of Young's modulus
10. Non Uniform bending – Optic Lever – Determination of Young's modulus
11. Cantilever – Scale and telescope – Determination of Young's modulus
12. Cantilever – Pin and Microscope – Determination of Young's modulus
13. Vertical oscillations of a spring – Determination of Young's modulus
14. One dimensional elastic collision – Hanging sphere method – Law of conservation of energy and momentum
15. Static Torsion – Determination of rigidity modulus
16. Flywheel – Determination of moment of inertia
17. Constant pressure head – Determination of viscosity of a liquid
18. Variable pressure head – Determination of viscosity of a liquid
19. Stokes's method – Determination of viscosity of a liquid
20. Capillary rise method – Determination of surface tension
21. Quincke's method – Determination of surface tension

3&4 (Second Year)
Core Practical 02: PH4CRP02 –Optics and Semiconductor Physics
1. Liquid Lens – Determination of optical constants of a convex lens – water and mercury given
2. Liquid Lens – Determination of refractive index of a liquid – water and unknown liquid
3. Spectrometer – Prism – Determination of refractive index of material of the prism
4. Spectrometer – Hollow Prism – Determination of refractive index of liquid
5. Spectrometer – Small angled prism – Normal incidence – Determination of refractive index of material of the prism
6. Spectrometer – i – d curve – Determination of refractive index of material of the prism
7. Newton's rings – Determination of wavelength of sodium light
8. The air wedge – Determination of diameter of thin wire
9. Zener characteristics – forward and reverse – Study of dynamic and static properties
10. Transistor characteristics – Common Emitter Configuration
11. Half wave rectifier – Study of ripple factor and load regulation with and without filter circuit

12. Full wave rectifier – (center tap) – Study of ripple factor and load regulation with and without filter circuit
13. Full wave rectifier – (bridge) – Study of ripple factor and load regulation with and without filter circuit
14. FET – characteristics – Determination of parameters
15. Voltage regulator using zener diode – Study of line and load regulations
16. Clippers – positive, negative and biased – Study of output waveforms
17. Clampers – positive, negative and biased – Study of output waveforms
18. OPAMP characteristics – Study of CMRR and open loop gain
19. OPAMP – inverter, non inverter and buffer – Study of gain
20. LC Oscillator – Colpit's /Hartley – using transistor
21. Phase shift oscillator – using transistor

SEMESTER 5&6 (Third Year)
Core Practical 03: PH6CRP03 – Electricity, Magnetism and LASER
1. Potentiometer – Measurement of resistance of wire
2. Potentiometer – Calibration of low range voltmeter
3. Potentiometer – Calibration of high range voltmeter
4. Potentiometer – Calibration of ammeter
5. Tangent galvanometer – Calibration of ammeter
6. Moving coil galvanometer – figure of merit
7. Conversion of galvanometer into voltmeter
8. Conversion of galvanometer into ammeter
9. Field along the axis of a circular coil – magnetic flux variation
10. Field along the axis of a circular coil – m and Bh
11. Searle's vibration magnetometer – magnetic moment
12. Deflection and vibration magnetometer – m and Bh
13. Carey Foster's bridge – Measurement of resistivity of wire
14. LCR seriesand parallel resonant circuit analysis
15. Verification of Thevenin's and Norton's theorems
16. Verification of Superposition and Maximum power transfer theorems.
17. Laser – Grating – Determination of wavelength
18. Laser – Determination of spot size and divergence
19. Optical fiber – Determination of numerical aperture
20. Single slit diffraction using laser – Determination of slit width
21. e/m – Thomson's apparatus – Bar magnet/magnetic focusing
22. Determination of Dielectric constant of a thin sheet/ a liquid

SEMESTER 5&6 (Third Year)
Core Practical 04: PH6CRP04 – Digital Electronics
1. Realization of logic gates – AND, OR and NOT – Using diodes, transistors etc.
2. Realization of logic gates – AND, OR and NOT – Using universal gates
3. Verification of truth table of NAND, NOR, XOR and XNOR gates
4. Verification of De Morgan's theorems – Using IC 7400
5. BCD to 7 segment decoder
6. Realization of Half adder/ Full adder using gates – Verification of truth table
7. Astable Multivibrator using Transistor

8. Astable Multivibrator using IC 555
9. Monostable Multivibrator using Transistor
10. Monostable Multivibrator using IC 555
11. D/A converter using IC 741 – Using binary weighed resistor / R – 2R ladder type
12. A/D converter using IC 741
13. SR Flip Flops using IC 7400 – Verification of truth table
14. JK Flip Flops using IC 7400 & 7410 – Verification of truth table
15. Digital counter using IC 7490 / 7495 / 74194 / 74151 – Verification of truth table
16. Schmitt trigger using IC 741
17. Bistable multivibrator using IC 555
18. Multiplexer using gates
19. Demultiplexer using gates
20. Shift register – SISO
21. Shift register – SIPO
22. 4-Bit Binary to Gray conversion
23. 4-Bit Gray to Binary conversion

SEMESTER 5&6 (Third Year)
Core Practical 05: PH6CRP05 – Thermal Physics, Spectroscopy and C++ Programming
1. Thermistor – Resistance - Temperature characteristics and temperature coefficient of resistance
2. Newton's law of cooling – Specific heat capacity of a liquid
3. Thermal conductivity of bad conductor – Lee's disc
4. Carey Foster's bridge – Temperature co-efficient of resistance
5. Study of Seeback effect/Peltier effect
6. Electrochemical equivalent of Copper
7. To determine e/k using transistor
8. Spectrometer – Cauchy's constants
9. Spectrometer – Resolving power of a prism.
10. Spectrometer – Resolving power of grating.
11. Spectrometer – Dispersive power of grating
12. Spectrometer – Dispersive power of prism
13. Computer programming in C++ – Conversion of temperature scale
14. Computer programming in C++ – Solving a quadratic equation
15. Computer programming in C++ – Generation of Fibonacci series
16. Computer programming in C++ – Conversion of a decimal number into binary number
17. Computer programming in C++ – Simple Pendulum – Calculation of 'g' from experimental data
18. Computer programming in C++ – Resistance colour code to numerical value conversion
19. Computer programming in C++ – For different initial velocity and angle of projection, find out time of flight, horizontal range, Maximum height of a Projectile
20. Computer programming in C++ – sorting the numbers in ascending and descending order
21. Computer programming in C++ – multiplication of two matrices

SEMESTER 5&6 (Third Year)
Core Practical 06: PH6CRP06 – Acoustics, Photonics and Advanced

Semiconductor Physics
1. Melde's string – Determination of frequency of given tuning fork
2. Sonometer – Determination of frequency of AC
3. Sonometer – Determination of frequency of given tuning fork, unknown mass and verification of laws of strings
4. Kundt's tube – Determination of velocity of sound
5. Spectrometer – Quartz prism – Refractive indices of quartz for the ordinary and extra –ordinary rays
6. Characteristics of LED – V- I characteristic for different colors
7. Characteristics of solar cell / photodiode – V- I characteristics
8. Characteristics of Light Depend Resistors
9. Planck's constant using LED's of at least 3 different colours
10. Weinbridge Oscillator using IC 741
11. Realization of XOR and Ex NOR using transistor
12. Sweep wave generator using transistor
13. Regulated power supply using zener diode and IC 741 – Study of line and load regulations
14. Regulated power supply using IC 78XX/79XX etc – Study of line and load regulations
15. Voltage regulator using zener diode and transistor – Study of line and load regulations
16. RC coupled common emitter amplifier – Study of frequency response and bandwidth
17. Voltage multipliers – doubler & tripler
18. Wave shaping R C circuits – Integrator and differentiator
19. OPAMP – adder and subtractor
20. Amplitude modulation using transistor
21. Pulse Width Modulation using IC 555

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2. Practical Physics – Joseph Ittiavirah, Premnath and Abraham(2005)
3. Practical Physics, CL Arora, S.Chand
4. Practical Physics, Harnam Singh , S Chand
5. Electronics lab manual Vol 1 & 2, K A Navas.
6. A course of Experiments with He –Ne Laser – R.S Sirohi (2nd Edition) Wiley Eastern Ltd.
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